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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

KEITH ANDREWS, an individual, TIFFANI ANDREWS, an individual, BACIU FAMILY LLC, a California limited liability company, ROBERT BOYDSTON, an individual, MORGAN CASTAGNOLA, an individual, THE EAGLE FLEET, LLC, a California limited liability company, ZACHARY FRAZIER, an individual, MIKE GANDALL, an individual, ALEXANDRA B. GEREMIA, as Trustee for the Alexandra Geremia Family Trust dated 8/5/1998, JIM GUELKER, an individual, JACQUES HABRA, an individual, MARK KIRKHART, an individual, MARY	**Case No. 2:15-cv-04113-PSG-JEM** [Consolidated with Case Nos. 2:15-CV-04573 PSG (JEMx), 2:15-CV-4759 PSG (JEMx), 2:15-CV-4989 PSG (JEMx), 2:15-CV-05118 PSG (JEMx), 2:15-CV-07051- PSG (JEMx)] **AMENDED AND SUPPLEMENTAL EXPERT REPORT OF PETER RUPERT, Ph.D.** August 30, 2019

KIRKHART, an individual, RICHARD LILYGREN, an individual, HWA HONG MUH, an individual, OCEAN ANGEL IV, LLC, a California limited liability company, PACIFIC RIM FISHERIES, INC., a California corporation, SARAH RATHBONE, an individual, COMMUNITY SEAFOOD LLC, a California limited liability company, SANTA BARBARA UNI, INC., a California corporation, SOUTHERN CAL SEAFOOD, INC., a California corporation, TRACTIDE MARINE CORP., a California corporation, WEI INTERNATIONAL TRADING INC., a California corporation and STEPHEN WILSON, an individual, individually and on behalf of others similarly situated,

Plaintiffs,

v.

PLAINS ALL AMERICAN PIPELINE, L.P., a Delaware limited partnership, PLAINS PIPELINE, L.P., a Texas limited partnership, and JOHN DOES 1 through 10,

Defendants.

I. INTRODUCTION

1. I am a Professor of Economics at the University of California, Santa Barbara and former Chair of the Economics Department. I am the Executive Director of the UCSB Economic Forecast Project (EFP). Along with Nobel Laureate Finn Kydland (Director) and as Associate Director, I run UCSB's Laboratory for Aggregate Economics and Finance (LAEF). I received my B.S. from Santa Clara University and my Ph.D. from the University of Rochester. My specialties include macroeconomics and labor economics. I have been at UCSB for twelve years, after teaching at several universities and eleven years at the Federal Reserve Bank of Cleveland as a Senior Economic Adviser. I am also an Associate Editor of the European Economic Review and Labor Economics. My curriculum vitae is attached below.

2. As Director of the EFP I oversee the collection of data for the local Santa Barbara community as well as surrounding areas. In addition, the EFP has conducted many economic impact studies for regional projects, events, and real estate developments. Economic impact studies are studies that quantify, in terms of output and employment, the economic benefits to the area of a business, event or any other entity that produces output and jobs. EFP's economic impact studies include: the Santa Barbara Airport, the Dallas Cowboys Training Camp in Oxnard, an apartment development in Santa Maria, as well as several oil industry studies commissioned by chambers of commerce. As an example, in 2011, the Santa Maria Valley Chamber of Commerce commissioned a project to analyze the economic impact of the oil and gas industry in Santa Barbara County. The study utilized economic modeling (IMPLAN Pro) and statistical analysis through the reliance of publicly available data as well as direct survey information and accounting documents provided to the UCSB Economic Forecast Project (EFP) by local oil and gas companies. The study was commissioned to show the extent of job creation, tax revenues, and the expansion of businesses due to the presence of the industry in the county.

3. I have been asked to analyze the effect of the Plains All American Pipeline rupture that occurred north of Refugio State Beach, near Santa Barbara, California in May, 2015, on the subsequent fish harvest and to estimate the Class's resulting damages.

4. I have amended the findings and opinions summarized in my report dated March 29, 2019 in light of the amendment to the definition of the Fisher Subclass that Plaintiffs have proposed, and in light of the amendments to the Expert Report of Hunter Lenihan, Ph.D.

5. The opinions below are based on findings reached to a reasonable degree of economic and scientific certainty. I reserve the right to amend this report to account for additional information. Information I relied upon or considered in forming my opinions are cited in this report and/or listed in the Appendix.

6. My hourly fee for this matter is $400.

7. I have served as an expert witness in this matter since 2017.

II. EXECUTIVE SUMMARY

8. The impact of the pipeline rupture and spill on fisheries can be measured with standard, reliable economic methods using available information on commercial landings from the California Department of Fish and Wildlife ("CDFW"). Lost profits to fishers and processors is determined using projected values had the rupture and spill not occurred compared to the actual outcomes, also using research found on the CDFW website.

9. Applying standard regression difference-in-differences techniques I can determine to a reasonable degree of certainty the extent to which the oil spill reduced the amount of fish caught in those blocks where oil was present, controlling for seasonality over the years.

10. The oil dispersion data are taken from the research of Professor Igor Mezic.

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III. PROCEDURE

A. Difference-in-Differences Regression Analysis

11. The expert opinions I offer in this case use regression and difference-in-differences analyses to identify and measure aggregate oil industry effects using aggregate, classwide proof. These are well-accepted scientific techniques. Joshua D. Angrist & Jorn-Steffen Pischke, MOSTLY HARMLESS ECONOMETRICS: AN EMPIRICIST'S COMPANION, Ch. 5 at 227 *et seq*. (Princeton University Press 2009). Difference-in-differences estimation has a long history throughout the sciences. This technique was first used as a method in the mid 1800's. It was invented to estimate causal effects in natural experiments. It is a regression framework that is best used to determine causal effects of an event or a policy change. These tools are highly reliable and useful because they enable an experienced investigator to determine the relationship between two or more variables. A regression using differences-in-differences can control for other observable factors, can show causation, and can quantify the degree to which variables caused an observable result.

12. The difference-in-differences approach has seen wide applicability when there is a program change, a policy intervention or a disrupting event such as a storm or an oil spill. The difference-in-differences estimator is defined as the difference in the average outcome in the treatment group before and after treatment minus the difference in the average outcome in the control group before and after treatment, therefore it is a "difference of differences." The dependent variable in the difference-in-differences regressions is the number of pounds of catch per month per ocean fishing block. Fishing blocks are spatial units of measure of the ocean along the California coastline, established by the CDFW. The total number of blocks considered is 253 blocks along the California coast from Block 631 (at Point Sal, 50-60 nautical miles north of the spill site) to Block 916 (near Coronado Island, off the coast of San Diego, south of the spill site). (Note: All of the blocks considered are in an addendum.) Within these blocks, I compared the

treated or "oiled" blocks to control blocks. The 165 "oiled" blocks were those identified by Dr. Mezic's model.[1] The remainder of the 253 blocks are control blocks.

13. The explanatory variables in the regression specification include: (1) An indicator variable that takes the value "1" if the block was ever oiled. (2) An indicator variable that takes the value "1" after the spill occurred in May, 2015. (3) An "interaction" term that multiplies (1) and (2) above for each year after the spill, 2015-2017. The coefficients on these interaction terms give the average difference between the pounds of fish caught in the blocks per month that were treated compared to the average pounds of fish caught in the control groups for each year after the rupture, and are the main variables of interest to determine the effect of oil in the water. (4) A set of 12 monthly fixed effects capture the seasonality of the fishing industry. According to the study performed by Dr. Mezic, oil was detected in the water from the date of the spill in May of 2015 until the end of August, 2015. This study uses Dr. Mezic's best estimate of a total release of 10,750 barrels in the ocean. The analysis was also done on Dr. Mezic's lower estimate of 8,000 barrels that appears as an Appendix to my report.

14. Summary statistics for landings indicates that there was a material decline in catch during 2015-2016 when compared to 2014, the year preceding the oil spill. These statistics are given in Table 1. Table 2 provides value per pound as reported by the CDFW as the total value in dollars divided by pounds of catch. With respect to the closure of parts of three blocks, 654-656, between May 19 and June 20, 2015, the Appendix table A.1 shows the effect on catch or this closure, compared to the same months in 2010-2014, based on CDFW landings data. Because only monthly data is available, the data does not reflect the difference in catch before and after the spill occurred on May 19, 2015. In addition, the closed area does not correspond exactly to the area covered by each fishing block. Nevertheless, this data reflects an overall decline in catch during May and June 2015 compared to the same period in prior years.

[1] PLAINS-EXPT-IM-000655.xlsx

Table 1: Summary Statistics Pounds of Catch

	2014	2015	2016	2017
Total	208,749,840	89,404,976	87,930,136	150,357,856

Table 2: Summary Statistics: $ Per Pound of Catch

	2014	2015	2016	2017
Total	0.51	0.75	0.84	0.71

B. Lost Profits

15. The goal is to determine what would have happened but for the rupture and spill, that is, what is the most likely counterfactual outcome compared to the actual outcome? Here I compare what the difference in revenue would have been had there not been a rupture and spill, thus determining causation, by comparing what actually happened to the value of the catch after the spill to a counterfactual world where prices continued on their trend from 2005 to April of 2015, the month before the spill, had the spill never occurred. If fixed and variable costs remain constant, any lost revenue would equal lost profit. For fishers who expended more effort after the spill, their lost profit may exceed their lost revenue.

16. A more conservative approach to lost profits is to adjust the lost revenues, based on published analyses of the portion of fishing revenues that translate to profits. I believe this to be an appropriate approach, but perhaps conservative because of the point made above that most of the costs were already borne by the Class as part of their ongoing fishing efforts. Data from the CDFW is used to determine lost profit where costs do not remain constant.

Several steps are involved:

Step 1: Prices are extrapolated according to the pre-spill trend in prices.

Step 2: The difference-in-differences regression is run but eliminates the interaction term. In other words, it forecasts using the regression as if the spill never occurred.

Step 3: The value of the catch is then calculated month by month over all of the blocks.

Step 4: Use the actual catch and the actual prices that occurred post spill.

Step 5: Compute the difference between Step 3 and Step 4.

Step 6: Compute the loss in profit using (1) the shares taken from the NOAA 2015 study Table A-13 and (2) The estimated input output coefficients taken from The Economic Structure of California's Commercial Fisheries on the CDFW website. According to the NOAA table the share going to the Captain (18.1%), Crew (17.8%) and Proprietor (18.1%) for a total of 54% going to profit after fixed and variable costs are taken into account.

17. Various government agencies have commissioned or sponsored extensive studies of the economics of the commercial fishing industry that assess, among other things, the portion of revenues for fishers and other industry participants that translate to profits versus being expended on other costs. These studies typically use input/output models and IMPLAN, which I discussed in an earlier report I submitted in this case. Dkt. Nos. 351-1, 400.

18. One example is The Economic Structure of California's Commercial Fisheries, which was commissioned by the California Department of Fish and Game. That study was designed to aid "fisheries managers, researchers, and stakeholders with the specialized economic modeling tools needed to examine the contribution of commercial fishermen to the economy of California and its coastal regions." It drew from an extensive survey data, statewide landing receipts and license datasets, and standard economic techniques and tools to develop the "California Ocean Fish Harvester Economic (COFHE) model," which can be used "to estimate economic impacts related to California's commercial fisheries." CDFW Report at ii, 1. The study reported coefficients

that described the percentage of fisher revenue attributed to "labor effects," which in the fisher industry corresponds to profits, i.e., the net revenue distributed to the proprietor, captain, and crew. Those data are broken out by species of seafood in Table 34 of the report. The coefficients can be weighted according to the catch made during the relevant time period, and then applied to the lost revenue figures reported above.

19. The Northwest Fisheries Science Center of the National Marine Fisheries Service (part of the National Oceanic and Atmospheric Administration) commissioned a similar report on Pacific Coast Fisheries. Description of the Input-Output Model for Pacific Coast Fisheries, NOAA Technical Memorandum NMFS-NWFSC-111 (June 2011). "The input-output model for Pacific Coast Fisheries (IO-PAC) is designed to estimate the gross changes in economic contributions and economic impacts resulting from policy, environmental, or other changes that affect fishery harvest." NOAA 2011 Report at ix. The study reported coefficients that described the percentage of fisher revenue attributable to the captain and crew payments, and proprietary income, which together in essence corresponds to profits. Likewise, it reported a coefficient for proprietary income for processors, which corresponds to profits in that sector. These coefficients can be weighted according to the catch makeup during the relevant time period, and then applied to the lost revenue figures reported above. The NOAA report has been updated at least twice since original publication, each time introducing additional refinements. I use data from the latest update of which I am aware, which was published in January 2015.

20. To find the loss to processors, it has been shown that processors receive 63.9% of the harvested fish.[2] The markup as defined in NOAA 015 Table A-16, is given as 1.83 for coastal pelagic species ("CPS").

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[2] Jerry Leonard, *Input-Output Model for Pacific Coast Fisheries, 2013 Revisions and Extensions*, Northwest Fisheries Science Center Fishery Resource Analysis and Monitoring Division (2013), http://www.pcouncil.org/wp-content/uploads/IOPAC_SSC_Econ_Review_April_NWC.pdf. I note that although this

IV. ANALYSIS

A. Original Certified Class

21. This section analyzes the effect of the oil spill on fish landings in the original certified blocks. Ground-fish only blocks are defined as California Department of Fish and Wildlife fishing blocks 631 to 633, 637 to 639, 643 to 645, 658 to 659, and 684 to 690, under the original class definition. Groundfish are defined by the CDFW as more than 90 species of bottom-dwelling marine fish, such as rockfish, sablefish and cod.[3]The Seafood blocks (all species, inclusive of Groundfish) are defined as CDFW fishing blocks 651 to 657, 664 to 671, and 681 to 683 under the original class definition.

22. To estimate the effect of the oil spill on pounds of landed fish a difference-in-differences regression approach is used on the above blocks. The approach captures the difference in the pounds of fish caught after the rupture of the pipeline. To that end, the model uses "control" and "treated" blocks before and after the rupture. The control blocks are those blocks that were not oiled as a result of the spill. The treated blocks are the blocks that contained oil released as a result of the spill (called "oiled blocks").

23. Table 3 shows the per month per block average catch for "seafood blocks" and "groundfish-only blocks" in the blocks that are part of the original certified class definition. The "afterBlock201X" is a dummy variable that accounts for fishing that would normally occur but for the oil spill in year X. The top three rows (after201X) show how fishing in the blocks was unfolding after the spill. Specifically, there was a downward trend overall for all the blocks after the spill. The fourth row, "typeBlock," indicates that on average oiled blocks had more catch than non-oiled blocks. The three bottom rows show results for treated, or oiled, blocks. The coefficients are the difference

number is computed for Oregon processors, there is no reason to believe it is a biased estimate of the value for California processors.

[3] https://www.wildlife.ca.gov/conservation/ marine/groundfish

between the control blocks and the treated blocks. The result of this analysis confirms that fishing in the "oiled" blocks was much lower than it would otherwise have been but for the oil spill, even when other factors are taken into consideration.

24. The regression results for the original class certified blocks where treated blocks are those that were oiled according to Dr. Mezic's analysis are given in Table 3:

Table 3
Difference-in-Differences, Treated=In Class
Original Certified Blocks

	Seafood	Groundfish
after2015	-52635.7***	-1263.4***
	(0.000)	(0.006)
after2016	-20671.5*	-1107.4***
	(0.064)	(0.008)
after2017	-33731.6***	-1551.0***
	(0.000)	(0.000)
typeBlock	198381.3***	-1511.9***
	(0.000)	(0.000)
afterBlock2015	-147485.9***	836.6*
	(0.001)	(0.089)
afterBlock2016	-173174.9***	720.2
	(0.000)	(0.101)
afterBlock2017	-82397.6*	1094.9***
	(0.079)	(0.005)
Observations	7484	5370
R^2	0.035	0.014

P-Values in parentheses. All regressions include monthly fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

25. The resulting losses for the Original Certified Blocks for Seafood (including Groundfish) are given in Table 4. The additional Groundfish only blocks in the original certified blocks showed no loss.

Table 4
Predicted Loss, Original Class Definition

Seafood	
Year	Treated=In Class
2015	-$8,545,578
2016	-$16,334,229
2017	-$9,150,471
Total	-$34,030,278

26. Applying the government agency coefficients to the Original Class Definition analysis described above and in Table 4, results in a lost profit range of $18,376,350 (using the largest category profit share of 54%) to -$34,030,278. The resulting loss of profits to processors is $(0.639*1.83*.078*-34,030,278) = -$3,103,931.

B. Oiled vs. Non-Oiled Regression

27. I have applied the difference-in-differences regression analysis described above, but now comparing “oiled” (treated) blocks to “non-oiled” (control) blocks, using Dr. Mezic’s most probable scenario of a total release of 10,750 barrels. This approach,

that imposes the fewest restrictions on the data, is a robust procedure for establishing causation and measuring damages.

28. The difference-in-differences regression results for this study are found in Table 5:

Table 5

Difference-in-Differences, Treated=Oiled

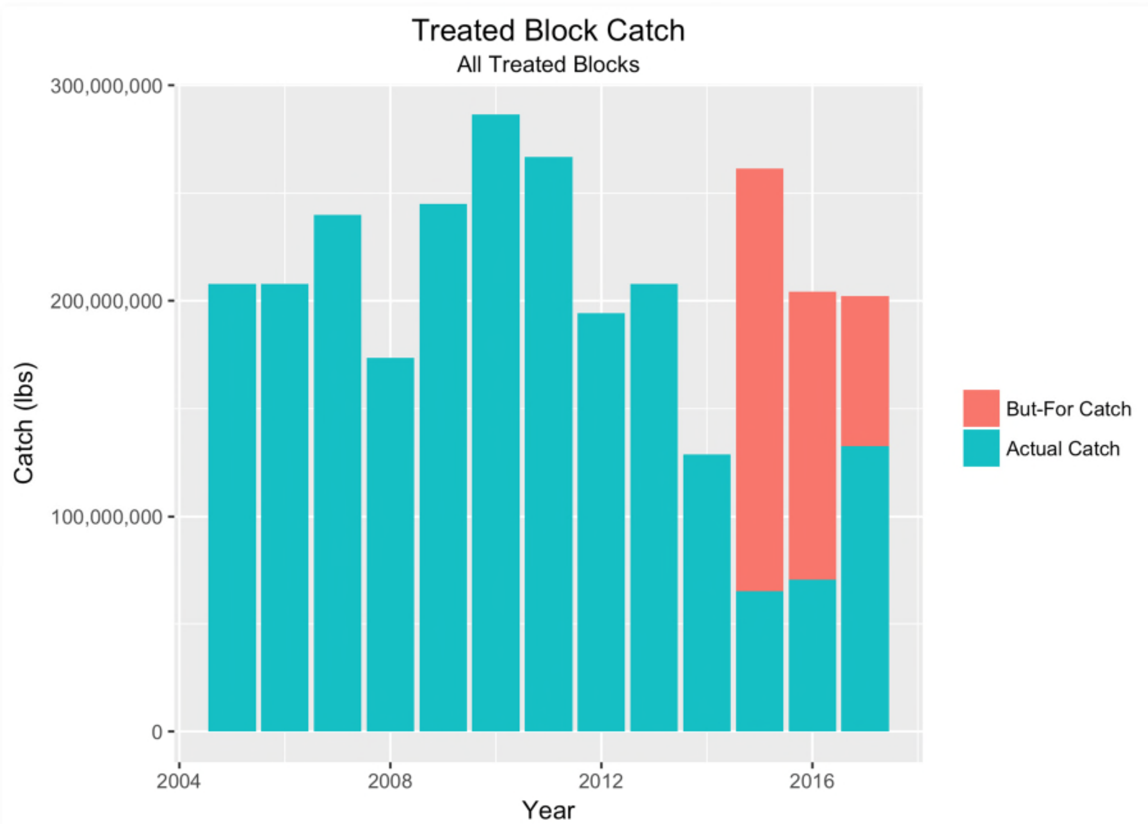
	Seafood
after2015	-34726.7***
	(0.000)
after2016	-20797.5*
	(0.058)
after2017	-32666.9***
	(0.000)
treated	193925.6***
	(0.000)
afterTreated2015	-146301.5***
	(0.000)
afterTreated2016	-143654.0***
	(0.000)
afterTreated2017	-71831.7***
	(0.004)
Observations	17161
R^2	0.024

P-Values in parentheses. All regressions include monthly fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

29. The difference-in-differences model provides a useful counterfactual if it were not for the spill. Removing the effects of the spill would have resulted in a pattern

of fish catch that is reasonably representative of the observed data prior to the spill as can be seen in the following graph. Note that 2014 was a particularly low catch year, as was 2008. Just as 2008 soon rebounded, if not for the spill 2015 was also predicted to rise closer to historical average.

Figure 1



30. Based on the difference-in-differences regression results found in Table 5, the resulting losses to fishers are given in Table 6:

Table 6

Losses, Treated=Oiled

Seafood	
Year	Treated=Oiled
2015	-$103,064,895
2016	-$94,248,005
2017	-$70,780,807
Total	-$268,073,707

31. As a lower bound on losses I have calculated the minimum price for each year based on the lowest monthly price in that year, taking the minimum observed seafood (original calculation) price in each year and applying it to the counterfactual catch in all months of that particular year. In 2015, that price is $0.378. In 2016, that price is $0.617. In 2017, that price is $0.587. The losses using these minimum prices instead of trend prices are given in Table 7:

Table 7

Losses, Treated=Oiled

Seafood	
Year	Treated=Oiled
2015	-$37,854,113
2016	-$65,096,409
2017	-$21,554,723
Total	-$124,505,245

32. Applying the above-mentioned government agency coefficients to the Oiled vs. Non-Oiled analysis described above and in Table 7, results in a lost profit range of $-67,232,832 (using the largest category profit share of 54%) to -$124,505,245. The resulting loss to processors is ($0.639*1.83*.078*124,505,245) = -$11,356,230.

C. Oiled vs. Non-Oiled Regression With Species Removed

33. In light of the proposed amendment to the definition of the Fisher Subclass, I performed the same regression above while eliminating "Groundfish" and "Highly Migratory Species," as defined by the CDFW and Pacific Fishery Management Council. I also excluded from my study two "oiled" blocks, 775 and 836, where CDFW records did not indicate any landings of the species still included in this regression.

34. When these elements are removed from the study, the magnitude of "difference" and loss of catch detected increases. This result is consistent with the hypothesis that the removed species were not impacted by the oil spill to the same extent as those species that remain in the analysis. The difference-in-differences regression results for this study are found in Table 8. Note that the names of the coefficients in the table have changed but the interpretation is analogous.

Table 8
Difference-in-Differences: Treated=Oiled

	Seafood
after2015	-63252.8***
	(0.000)
after2016	-18674.5
	(0.182)
after2017	-41711.7***
	(0.000)
treated	225103.4***
	(0.000)
afterTreated2015	-132686.9***
	(0.000)
afterTreated2016	-162695.7***
	(0.000)
afterTreated2017	-69647.0**
	(0.021)
Observations	13995
R^2	0.026

P-Values in parentheses. All regressions include monthly fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

35. Based on the difference-in-differences regression results found in Table 7, the resulting losses to fishers are given in Table 9:

Table 9
Losses: Treated=Oiled
Oiled vs. Non-Oiled With Species Removed

Seafood	
Year	Treated=Oiled
2015	-$47,151,471
2016	-$78,233,319
2017	-$48,265,269
Total	-$173,650,059

36. Applying the above-mentioned government agency coefficients to the analysis described above and in Table 7, results in a lost profit range of $-93,771,032 (using the largest category profit share of 54%) to -$173,650,059. The resulting loss to processors is ($0.639*1.83*.078*173,650,059) = -$15,838,771.

37. As I did for Table 7 above, I have calculated the minimum price for each year based on the lowest monthly price in that year. For the species analyzed in this regression, in 2015, that price is $0.378. In 2016, that price is $0.587. In 2017, that price is $0.617. The losses using these minimum prices instead of trend prices are given in Table 10:

Table 10
Losses: Using minimum prices
Oiled vs. Non-Oiled With Species Removed

Seafood	
Year	Treated=Oiled
2015	-$13,15,197
2016	-$57,752,742
2017	-$23,617,920
Total	-$94,505,859

38. Applying the above-mentioned government agency coefficients to the Oiled vs. Non-Oiled With Species Removed analysis described above and in Table 7, results in a lost profit range of $-85,370,364 (using the largest category profit share of 54%) to -$158,093,266. The resulting loss to processors is ($0.639*1.83*.078*158,093,266) = -$14,419,823.

C. Amended Class Definition

39. In addition, I was asked to perform a regression where the "treated blocks" are defined as the blocks included in Plaintiffs' proposed amended class: 651-656, 664-670, 678-686, 701-707, 718-726, 739-746, 760-764, 806-809. In this regression I also eliminated Groundfish and Highly Migratory Species.

40. The difference-in-differences regression results for this study are found in Table 11:

Table 11

Difference-in-Differences: Treated=Oiled, Amended Class Blocks

	Seafood
after2015	-71080.2***
	(0.000)
after2016	-13437.5
	(0.362)
after2017	-40584.6***
	(0.000)
treated	335700.9***
	(0.000)
afterTreated2015	-280397.1***
	(0.000)
afterTreated2016	-293146.9***
	(0.000)
afterTreated2017	-195274.6***
	(0.000)
Observations	9388
R^2	0.044

P-Values in parentheses. All regressions include monthly fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

41. The resulting losses for using the amended class blocks as the treated blocks are presented in Table 12:

Table 12

Losses: Treated=Oiled, Amended Class Blocks

Year	Treated=In Class
2015	-$47,511,063
2016	-$78,682,839
2017	-$59,388,734
Total	-$185,582,634

42. To further confirm that the oil spill was the cause of the reduction in catch my analysis has measured, I performed a procedure wherein I iteratively reclassified oiled blocks as control blocks, ranked from most to least oiled. The procedure is as follows. First, I aggregated the amount of oil in each block for each month by summing the 15-minute oil levels predicted by Dr. Mezic's model. I then assigned each block a ranking based on the maximum amount of oil present in any particular month. Finally, I iteratively reclassified oiled blocks as control blocks based on oil rank, working from least oiled to most oiled. The overall result is that as blocks lower in the ranking were re-classified as control blocks, the regression coefficients increased. Once I began re-classifying highly oiled blocks as control blocks, the regression coefficients then began to decline. This "hump-shape" provides additional evidence that oil being present in the water is in fact to blame for the reduction in catch.

43. One additional point can be made about the "amended class" analysis. My understanding is that Class membership is based on having fished in the designated blocks. Based on the available information that I have reviewed to date, regarding the

number of fishing vessels in the larger area compared to those identified as part of the class as defined, it appears that the current set of Class members is reasonably coextensive with the fishers that incurred losses in the larger area. If not, the calculated damages figure can be apportioned to just the class members by assessing available CDFW licensure and vessel data. In the most straightforward analysis, I can compare the relative numbers of licenses operating in the Class blocks versus those in the larger area, and adjust the damages figure down proportionally. That analysis can be further refined by incorporating landing data associated with these licenses and vessels. Moreover, this approach based on comparison of licensure and vessel data should work to accommodate any issues around the potential inclusion of non-class member damages in my analysis.

I certify that the foregoing is true and correct.

Executed on August 30, 2019 at Santa Barbara, California.

Dr. Peter Rupert, Ph.D.

V. APPENDIX

Regression Output: 8,000 Barrel Model

	Seafood
after2015	-34344.1***
	(0.000)
after2016	-21074.0*
	(0.055)
after2017	-32762.5***
	(0.000)
treated	194610.1***
	(0.000)
afterTreated2015	-146998.4***
	(0.000)
afterTreated2016	-143496.0***
	(0.000)
afterTreated2017	-73197.9***
	(0.003)
Observations	17161
R^2	0.024

P-Values in parentheses. All regressions include monthly fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Losses: 8,000 Barrel Model

Seafood	
Year	Treated=Oiled
2015	-$103,551,655
2016	-$94,132,758
2017	-$72,431,936
Total	-$270,116,349

Table A.1

MAY CATCH									
	Value					Pounds			
Year	654	655	656	Total		654	655	656	Total
2010	$27,080.77		$17,876.30	$44,957.07		23,495.10		13,851.00	37,346.10
2011	$33,441.75		$69,095.40	$102,537.15		27,840.10		249,485.00	277,325.10
2012	$19,793.80	$3,363.52	$22,434.73	$45,592.05		14,994.50	1,152.50	13,007.70	29,154.70
2013	$16,375.26	$14,087.18	$17,999.95	$48,462.39		10,066.81	11,359.20	27,400.60	48,826.61
2014	$46,324.05	$10,638.53	$23,799.20	$80,761.78		31,116.35	11,094.05	15,181.30	57,391.70
2015	$50,663.64	$40,377.38	$17,252.25	$108,293.27		25,076.00	11,739.05	10,218.00	47,033.05

JUNE CATCH									
	Value					Pounds			
Year	654	655	656	Total		654	655	656	Total
2010	$35,542.80	$8,798.20	$19,562.15	$63,903.15		23,693.80	3,786.60	14,068.50	41,548.90
2011	$87,100.75	$2,859.95	$26,160.85	$116,121.55		41,014.80	691.00	17,820.50	59,526.30
2012	$54,040.30	$10,393.20	$27,070.21	$91,503.71		25,068.10	5,095.80	17,183.00	47,346.90
2013	$31,805.65	$211,162.93	$126,171.00	$369,139.58		17,818.00	623,216.90	357,378.20	998,413.10
2014	$69,918.33	$7,885.13	$405,471.83	$483,275.28		31,413.90	2,004.30	1,290,837.50	1,324,255.70
2015	$35,058.34	$2,142.88	$7,157.30	$44,358.52		8,216.20	686.60	4,147.20	13,050.00

APPENDIX A

AMENDED MATERIALS CONSIDERED BY PETER RUPERT

California Department of Fish and Game, Southern California Fisheries Chart, https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=67449

California Department of Fish and Wildlife, Nearshore Fishing Block Maps used for Commercial Edible Seaweed and Agar Algae Harvest, https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=84551 California Department of Fish and Wildlife, Groundfish, https://www.wildlife.ca.gov/conservation/marine/groundfish

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CDFW Aggregate Landings Data: CDFW Aggregate Landings Data: PLTF-EXPT-HL-0001538, PLTF- EXPT-HL-0001539, PLTF-EXPT-HL-0001540, PLTF-EXPT-HL-0001541, PLTF-EXPT-HL-0001542, PLTF-EXPT-HL-0001543, PLTF-EXPT-HL-0001544, PLTF-EXPT-HL-0001545, PLTF-EXPT-HL- 0001689

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Pacific Fishery Management Council and National Marine Fisheries Service, Harvest Specifications and Management Measures for 2015-2016 and Biennial Periods Thereafter (2015) https://www.nwfsc.noaa.gov/news/events/program_reviews/2017/documents/IO-PAC%20Appendix%20to%20Harvest%20Specifications%20and%20Management%20Measures%20for %202015-2016%20and%20Biennial%20Periods%20Thereafter.pdf

Steinback and Thunberg, Northeast Region Commercial Fishing Input-Output Model, NOAA Technical Memorandum NMFS-NE-188 (2006), https://www.nefsc.noaa.gov/publications/tm/tm188/tm188.pdf Coefficients with Categorization Data, REL-0000158329

Hachett et al., The Economic Structure of California’s Commercial Fisheries, California Department of Fish and Game (2009), https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=30741&inline

National Marine Fisheries Service. 2018. Fisheries Economics of the United States, 2016. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-F/SPO-187, 243 p. https://www.fisheries.noaa.gov/resource/document/fisheries-economics-united-states-report-2016

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